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SYSTEM AND METHOD FOR DISPLAYING CLOSED CAPTIONS IN AN  
INTERACTIVE TV ENVIRONMENT

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CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to U.S. Provisional Patent application Serial No.60/230,038, entitled SYSTEM AND METHOD FOR DISPLAYING CLOSED CAPTIONS IN AN INTERACTIVE TV ENVIRONMENT filed on September 1, 2000, the contents of which are incorporated herein by reference.

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FIELD OF THE INVENTION

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The present invention relates generally to processing and displaying video data and more particularly to processing and displaying closed captioning data in an interactive television system.

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BACKGROUND

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Video data frequently includes data, such as, for example, closed caption text data, that is transmitted during the vertical blanking interval (VBI) of the video signal. The National Television Standards Committee (NTSC) has promulgated a standard format wherein the closed caption text is transmitted during line twenty-one of either the odd or even field of the video frame.

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In the United States, conventional television systems, with picture screens 33 cm (13 in) or larger, are mandated to include a closed caption decoder. Closed caption decoders strip the encoded data from the video signal, decode the data, and reformat the data for display, concurrent with the video program, on a television screen. In accordance with standards promulgated by the Federal Communications Commission (FCC), closed caption text consists of up to four rows of text. Conventionally the captioning text may be positioned nearly anywhere on the TV screen. The text may paint-on from left to right, it may pop-on (like a movie subtitle), or it may roll-up (like a newscaster's teleprompter). The failure to standardize the display of closed

caption text creates potential conflicts with modern interactive television systems.

Interactive television ("ITV") combines conventional television with additional content ("interactive content") to present a viewer with an enhanced television viewing environment that provides game play, supplemental information, or other forms of interactivity. In an interactive TV environment, the main video program image is often reduced in size and positioned in one corner of the TV screen. The remaining area of the screen may be used for ITV text and graphics such as informational screens or prompts for the viewer.

When an interactive TV program is being displayed, conventional ITV receivers often filter or remove the closed caption text from the outgoing video signal. This, in turn, disables the display of caption text on a television connected to the ITV receiver. The caption text is removed to avoid conflicts between the display of caption text and the display of interactive TV text and graphics. For example, if caption text were allowed, it might obscure a critical ITV message or at times, closed caption text may overlay critical areas of a windowed video program image.

Accordingly, it would be advantageous to provide a system and method whereby closed caption data is reformatted for display in an ITV environment. The present invention allows caption text and interactive images to coexist on the same display thereby allowing the hearing impaired to enjoy the benefits of interactive television.

#### SUMMARY OF THE INVENTION

In one aspect of the present invention a method for displaying closed captions encoded in a video signal includes allocating a screen area for displaying the closed captions, receiving the video signal and ITV data and relocating the closed captions to the allocated screen area.

1 In another aspect of the present invention a method of  
displaying closed captions encoded in a video signal includes  
receiving the video signal and ITV data, determining if a  
5 conflict exists between the screen location of the closed  
captions and screen location of the ITV data and relocating the  
closed captions in accordance with the conflict determination.

10 In another aspect of the present invention a method of  
displaying closed captions encoded in a video signal includes  
receiving the video signal and ITV data, determining the screen  
location of the closed captions, determining the screen location  
of the ITV data and relocating at least a portion of the closed  
captions whose screen location conflicts with the screen location  
of the ITV data.

15 In a further aspect of the present invention an interactive  
television receiver includes means for allocating a screen area  
for displaying closed captions, means for receiving the video  
signal, means for receiving ITV data and means for relocating the  
closed captions to the allocated screen area.

#### 20 BRIEF DESCRIPTION OF THE DRAWINGS

25 These and other features, aspects, and advantages of the  
present invention will become better understood with regard to  
the following description, appended claims, and accompanying  
drawings where:

FIG. 1 illustrates a grid indicating where closed captions  
may be placed on a TV screen;

FIG. 2 illustrates an interactive TV environment in  
accordance with an exemplary embodiment of the present invention;

30 FIG. 3 is a system level block diagram of a typical hookup  
of an interactive TV receiver;

FIG. 4 graphically illustrates an interactive TV environment  
with conflicting closed caption text;

35 FIG. 5 is a simplified block diagram of standard interactive  
TV system;

FIG. 6 is a simplified block diagram of an ITV receiver in accordance with an exemplary embodiment of the present invention;

FIG. 7 is a flow diagram of a interactive TV environment for relocating closed captioning in accordance with an exemplary embodiment of the present invention;

FIG. 8 illustrates an interactive TV environment with reformatted caption text in accordance with an exemplary embodiment of the present invention;

FIG. 9 illustrates what the viewer sees when captions are reformatted for an interactive environment;

FIG. 10 is a flow diagram of an alternative interactive TV environment for relocating closed captioning in accordance with an exemplary embodiment of the present invention;

FIG. 11 is a flow diagram of a further alternative interactive TV environment for relocating closed captioning in accordance with an alternate embodiment of the present invention;

FIG. 12 is a flow diagram of a further alternative interactive TV environment for relocating closed captioning in accordance with an alternate embodiment of the present invention;

FIGS. 13a and 13b graphically illustrate the modification of the row positioning codes to relocate closed caption data to an allocated screen area in accordance with an exemplary embodiment of the present invention;

FIGS. 14a and 14b graphically illustrate the modification of caption positioning codes to resize the caption and relocate the closed caption to an allocated screen area in accordance with an exemplary embodiment of the present invention; and

FIGS. 15a and 15b graphically illustrate the modification of caption positioning codes to separate an incoming caption into two rows and to relocate the closed caption to an allocated screen area in accordance with an exemplary embodiment of the present invention.

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## DETAILED DESCRIPTION OF THE INVENTION

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In an exemplary embodiment of the present invention, a signal processing system is employed to reformat closed caption text for display in an ITV environment in a way that does not conflict with the displayed interactive images. Television receiver regulations in the United States require televisions with picture screens 33 cm (13 in) or larger be able to process signals which contain information in an encoded data format within line 21, field 1 of the scanned television raster. The processed signal may then be used to display closed captioning information (Federal Communications Commission Report and Order on GEN Docket No. 91-1, dated Apr. 12, 1991). Therefore, most television receivers currently in use in the United States today contain closed caption decoders.

The closed caption standard for NTSC television requires captioning text be positioned on the display screen within a safe caption area. In the NTSC standards the safe caption display area is divided into 15 character rows of text of equal height and 32 columns of equal width as illustrated in FIG. 1. The caption display grid is intended to provide for accurate on screen placement of captioning text. The creator of the captioning data should therefore locate the captioning data within these established columns and rows. In addition, FCC regulations further require that caption characters should be clearly and separately displayed from the video over which they are placed.

In caption mode, text can appear in up to four rows simultaneously anywhere on the screen within the defined display area. In addition, a solid space equal to one column width may be placed before the first character and after the last character of each row to enhance legibility. The caption area will be transparent anywhere that no standard space character or other character has been addressed and no accompanying solid space is needed. In practice, captioning text is displayed in a limited

1 number of rows, typically two or three, to minimize obscuration  
of the video program. Digital TV closed captioning, as described  
in the EIA-708 specification, has a similar grid structure.

5 The presentation of an interactive TV program on the other  
hand is not subject to standardized requirements. A typical  
interactive TV environment, designed by an ITV author, may  
consist of text and graphic images that enhance the video  
program. Typically the creator of the ITV program reduces the  
10 size of the video program 20 and locates the program in one  
corner of the display screen 22 as shown in FIG. 2. In this  
particular example, the ITV author has reduced the size of the  
video image and located it in the upper right corner of the  
display screen. The ITV author may freely utilize the remaining  
15 space on the display screen to provide a menu of choices 24 for  
the ITV viewer together with advertisements 26 or other  
interactive content.

Referring to FIG. 3, for a conventional interactive TV  
system, the video signal is first processed by an ITV receiver  
30 before being conveyed to a TV receiver 32. Consequently, the  
closed caption decoder function (typically resident in the TV)  
occurs after the ITV function so that the captioning may still  
be displayed anywhere on the entire TV screen, and is not limited  
20 to the reduced video image that typically appears in one corner  
of the screen. Therefore, it is probable that in some instances  
closed caption text will overlay portions of the ITV environment  
thereby causing a conflict.

Conflict between closed caption text and ITV data may occur  
because the creator of the closed caption text has no prior  
knowledge, or concern, of where interactive TV elements may be  
30 placed on screen. FIG. 4 illustrates a closed caption 40  
displayed outside the video image and overlaid on an ITV  
advertisement 42. To avoid these types of conflicts,  
conventional ITV receivers often filter closed caption data,  
removing it from the signal that is forwarded to the TV receiver  
35 when an interactive program is being viewed. The filtering of

1 the closed captions prevents closed captions from being displayed on screen during that program.

5 An exemplary embodiment of the present invention provides a method for repositioning the closed caption text in an area of the TV screen defined by the ITV author, thereby restoring the closed caption service for interactive TV programs. The advantages of the present invention may best be illustrated in the context of an exemplary ITV system. FIG 5 illustrates the overall signal and data flow for an exemplary interactive TV system. During the production phase of a TV program or commercial, the program is edited from one or more master recordings 50. In accordance with an exemplary embodiment a data encoder 52 may embed certain URL links and command triggers into the program. In one embodiment the data encoder may embed the URL links and command triggers in the vertical blanking interval (VBI) of the video portion of the program. The modified program is recorded by a data recorder 54 for subsequent broadcast.

15 When desired, the modified TV program is broadcast, along with the embedded URLs and/or command triggers, by means of a data player 56 and broadcast station 58. These URLs and triggers cause an ITV receiver 60 in a viewer's home to retrieve enhanced content from the Internet 62 by way of a telephone interface 64. In the described exemplary embodiment the telephone interface provides two way communication between the viewer and an ITV server 66. The telephone interface may also provide the majority of the interactive content as the bandwidth reserved for ITV data in today's TV transmissions is often very low.

25 The ITV receiver 60 receives and decodes the ITV data in the form of, for example, Uniform Resource Locators ("URLs"), triggers (e.g., Java-script program calls), and/or other commands, which may then be used to access the interactive content from a remote location. The TV program, along with the retrieved content, may then be displayed on a television or other display 70.

35 FIG. 6 illustrates an exemplary ITV receiver 60 that may

1 incorporate the described exemplary method for integrating closed  
captions into an ITV environment. One of skill in the art will  
appreciate that the present invention is not limited to a  
5 particular type of ITV receiver or ITV system. Rather, the  
present invention may be integrated into all ITV receivers to  
provide closed caption capability in an ITV environment. For  
example, the present invention may be integrated into stand alone  
units such as the WebTV or AOLTV receivers. Similarly the  
10 present invention may also be utilized by integrated systems such  
as the DishPlayer from Dish Networks which contains WebTV  
functionality. Further, the present invention may be  
incorporated into ITV receivers that utilize an analog video  
sources such as the WebTV or AOLTV units as well receivers that  
15 utilize compressed MPEG digital video sources, such as the  
DCT2000 from Motorola (formally General Instruments) running ITV  
"middleware" software.

The described exemplary ITV receiver may include an infrared  
remote interface 80 or other interface to allow for the reception  
of input commands from a system user. An exemplary remote  
20 interface includes an IR receiver (not shown) that converts the  
received optical signals to an electrical output that is  
forwarded to a central processing unit (CPU) 82 for  
interpretation. In accordance with an exemplary embodiment the  
CPU 82 may be for example, a MIPS, ARM, Pentium or other  
25 processors known in the art. The CPU 82 processes user inputs  
and controls the various peripherals of the ITV receiver, such  
as channel changing and modem functions.

In the described exemplary embodiment an incoming video  
30 signal 84 contains a source of ITV data as well as closed caption  
information. The incoming video signal is forwarded to a data  
decoder 86 that recovers the ITV data and the closed caption data  
from the incoming video. For analog solutions, the data decoder  
recovers data from the vertical blanking interval of the video  
35 signal (scan lines 10-21). For digital solutions, the decoder  
recovers data that is addressed with a unique packet ID.



1 The ITV data may include, for example, URLs that point the  
ITV receiver 60 to externally located HTML pages, or, the data  
may contain the actual ITV content. In the described exemplary  
embodiment the closed caption data comprises screen addressing  
5 control codes, spaces, and text. The data decoder 86 forwards  
the ITV data and the closed caption data to the CPU 82 for  
processing. In the described exemplary embodiment a network  
interface 88 provides a connection to the Internet through which  
10 the CPU 82 may retrieve external ITV content and report  
information about the user. The network interface 88 may be  
facilitated via a dial-up connection, or it may be an interface  
to a two way data transfer system in a cable TV environment.  
Alternatively, the described exemplary ITV receiver may contain  
15 an Ethernet port that connects directly to the Internet or local  
area network that has access to the Internet.

In accordance with an exemplary embodiment, the CPU 82  
interprets the ITV code and closed captioning screen address  
control codes to determine screen positioning of the ITV data and  
the caption data. The described exemplary CPU 82 may then  
20 determine whether a conflict exists between the screen position  
of the ITV data and the closed caption data. An exemplary CPU  
may then modify at least a portion of the closed caption  
positioning control codes and spaces to cause the captions to be  
25 displayed in area of the screen that does not conflict with the  
ITV data. In one embodiment the CPU 82 may forward the modified  
closed caption data to a data encoder 92 that encodes the closed  
caption data with modified control codes into the outgoing video  
signal. Alternatively, the CPU may forward the closed caption  
30 data having modified control codes to an on screen display  
generator 90 that burns the closed caption into the video signal.  
In this embodiment, a viewer could enable or disable the display  
of closed captions via the remote interface 80.

In the described exemplary embodiment, the CPU 82 runs a  
35 form of a browser that interprets and renders ITV content and  
forwards appropriate content to the on screen display generator

1 90. The on screen display generator 90 overlays text and graphical information on top of the video signal 84 and outputs an ITV program for display on a television or other display (see FIG. 5).

5 Typical television receivers employ customer selectable modes of operation for television and caption. In operation, when a viewer activates the caption mode on his/her television set, the caption text is displayed on the television screen. The text is displayed in a format prescribed by the author of the closed captions. There are three styles of presenting text in caption mode, namely roll-up, pop-on, and paint-on style captioning.

10 Roll-up style captioning may simultaneously display either two, three or four contiguous rows of text. Each time a carriage return is received, the text in the top row of the window is erased from memory and from the display or scrolled off the top of the window. The remaining rows of text are each rolled up into the next highest row in the window, leaving the base row blank and ready to accept new text. The roll-up rate is timed so as to appear smooth to the user.

15 Pop-on style captioning is initiated by receipt of a resume caption loading command. Subsequent data are loaded into a non-displayed memory and held there until an end of caption command is received, at which point the non-displayed memory becomes the displayed memory and vice versa. Paint-on style captioning immediately addresses data to displayed memory without need for an end of caption command.

20 An exemplary embodiment of the present invention provides a method for repositioning the closed caption text in an area of the TV screen defined by the ITV author, thereby restoring closed caption service for interactive TV programs. In accordance with an exemplary embodiment closed caption text is positioned by using a series of two byte control codes that precede the text. Default positions may also be defined when no addressing code is provided. In addition, spaces may also be used to horizontally

1 locate captions. Referring to FIG. 7, in an exemplary embodiment  
of the present invention an ITV receiver reads the closed caption  
control codes 700. The described exemplary receiver examines the  
5 screen addressing control codes, spaces, and text to determine  
screen positioning of the caption data 710 as broadcast.

In an exemplary embodiment of the present invention an ITV  
content provider allocates an area of the TV screen for placement  
of closed captioning content. The ITV receiver then, knowing  
10 where space is allocated in a particular ITV environment,  
compares the screen position of the closed caption data with the  
screen position of the ITV data 720 to determine if a conflict  
exists 730. The described exemplary ITV receiver does not  
relocate the closed caption data if its display position does not  
15 conflict with the display of the ITV data 750. However, if a  
conflict does exist between the screen position of the closed  
caption data as broadcast and the ITV data, the receiver may  
modify certain positioning control codes and spaces to cause the  
caption data to be displayed in the area allocated for placement  
20 of closed captions 740.

In accordance with an exemplary embodiment, the ITV receiver  
may utilize standard EIA-608 positioning control codes to control  
the placement of the closed caption data. Appendix A attached  
hereto and incorporated herein by reference includes a  
25 comprehensive list of control codes that may be utilized by an  
exemplary receiver. One of skill in the art will appreciate that  
the present invention is not limited to the use of EIA-608  
positioning control codes, but may utilize any positioning codes  
to control the placement of the closed caption data. Therefore  
30 the described exemplary positioning control codes are by way of  
example only and not by way of limitation.

In some cases, an exemplary ITV receiver may add carriage  
returns to the caption data to divide a caption into smaller  
lines because the area allocated for the display of captions by  
the ITV author may not encompass all 31 columns. FIG. 8  
35 illustrates the addition of carriage returns to reduce the line

1 length of the caption displayed in FIG. 4. In this example the  
caption has been increased to three rows for display within an  
allocated area that is roughly from column 11 to column 30. FIG.  
5 9 shows the resulting display. In addition, an exemplary ITV  
receiver may convert the captions from the pop-on presentation  
style to the roll-up style in order to display all of the text  
in the allotted time (the time specified by the caption author).

Referring to FIG. 10, in another embodiment of the present  
10 invention, the ITV content provider again allocates an area of  
the display screen for placement of closed caption data. The  
described exemplary ITV receiver reads the closed caption data  
1000 and examines the screen addressing control codes, spaces,  
and text to determine the screen position of the caption data  
1010 as broadcast. Knowing where space is allocated in a  
15 particular ITV environment, the described exemplary ITV receiver  
may then determine if the caption data as broadcast is contained  
within the screen area allocated for the display of caption data  
1020. If so the described exemplary ITV receiver may simply  
20 display the caption data as broadcast 1030. Otherwise the  
described exemplary ITV receiver relocates the caption data to  
the allocated screen space 1040. In accordance with an exemplary  
embodiment, the ITV receiver may modify certain positioning  
control codes and spaces to cause the captions to be displayed  
25 in a screen area allocated for the display of closed caption.

Referring to FIG. 11, in another embodiment of the present  
invention, the ITV content provider allocates a given number of  
rows and columns within which closed caption data may be  
displayed. However, in this embodiment the dedicated screen area  
30 may be located anywhere on the TV screen. In this embodiment an  
ITV receiver reads the closed caption data 1100 and examines the  
screen addressing control codes, spaces, and text to determine  
the screen positioning of the closed caption data 1110. The  
described exemplary ITV receiver may also determine the location  
35 of the screen area allocated for presentation of closed  
captioning 1120. In one embodiment the ITV content creator may

1 provide control codes that specify the location of the allocated space.

5 In accordance with an exemplary embodiment, the ITV receiver may then compare the screen position of the closed caption data with the screen position of the ITV data 1130 to determine if a conflict exists 1140. If a conflict exists between the closed captioning placed in its normal position, and the ITV data, an exemplary ITV receiver may modify certain control codes and spaces to cause the closed caption data to be displayed in the 10 area allocated for the display of closed captions 1150. In accordance with an exemplary embodiment, the ITV receiver does not alter the position control codes of the closed caption data if its screen position does not conflict with the screen position of the ITV data 1160.

15 FIG. 12 is a flow chart graphically illustrating a method for modifying the positioning control codes of closed caption data to locate the closed caption data in an area of a display screen defined by the ITV author. In accordance with an exemplary embodiment, an ITV receiver may first determine if the 20 incoming caption is positioned within the screen area allocated for the display of closed caption data 1200. If so, no conflict exists with the ITV data and an exemplary ITV receiver does not modify the positioning control codes of the closed caption 1200(a).

25 However, an exemplary ITV receiver may modify the positioning control codes of closed captions that are not contained within the screen area allocated for the display of closed captions. In operation, an exemplary ITV receiver may first determine if the closed caption as broadcast will fit in 30 the allocated area without modifying the horizontal placement of characters 1210. If so, the described exemplary ITV receiver may modify the row positioning control codes to relocate the closed caption within the screen area allocated for the display of captions 1220.

35 If the caption can not be vertically repositioned so as to

1 fit within the area allocated for the display of closed captions,  
the described exemplary ITV receiver may determine whether the  
caption may be repositioned horizontally so as to fit within the  
5 screen area designated for the display of closed captions 1230.  
If so, the described exemplary ITV receiver may modify the column  
positioning control codes 1240 to relocate the closed caption  
within the area allocated for the display of captions.

10 If not the described exemplary ITV receiver may resize the  
caption before relocating it to the screen area allocated for the  
display of closed captions. In accordance with an exemplary  
embodiment, an ITV receiver may relocate the first character of  
the incoming closed caption to the first grid position of the  
screen area allocated for the display of closed captions 1250.  
15 The described exemplary receiver may then determine whether there  
are more characters in the incoming caption 1260.

20 If not, an exemplary ITV receiver may optimize the display  
of the caption 1270. For example, the caption may be modified  
to have even rows and text centered within the screen area  
allocated for the display of caption data. If there are  
additional characters in the incoming caption, an exemplary  
receiver may relocate the next character of the incoming caption  
to the next position of the allocated screen area 1280. The  
described exemplary embodiment may determine if there is  
25 additional space in the screen area allocated for the display of  
closed captions 1290. If there is no more space remaining in the  
allocated screen area, an exemplary ITV receiver may utilize a  
roll-up style to display the caption 1300.

30 If there is additional space remaining in the screen area  
allocated for the display of captions 1290(a) the ITV receiver  
will again determine whether there are additional characters in  
the caption 1260 and if so relocate the next character to the  
next position of the allocated screen area 1280. In the  
described exemplary embodiment, the relocation of closed caption  
characters continues until all of the characters of the incoming  
35 caption are relocated or until there is no more space in the

1 screen area allocated for the display of closed captions in which case the ITV receiver switches to roll-up style captioning.

5 The described exemplary method for relocating closed captions may be best illustrated by a series of illustrative examples. In a first example it is assumed that a ITV content creator allocates a rectangular screen area bound by the grid coordinates of row 13 column 4 and row 14 column 28 for the display of closed caption. Further, for the purposes of illustration assume the following positioning control codes and text are received by the described exemplary ITV receiver.

14 20 11 72 11 39 And now, a few words 12 54 14 21  
from our sponsors. 14 2F

15 Referring to the EIA-608 control code tables contained in index A, the code "14 20" is a "resume caption loading" command that prompts the ITV receiver to load the received caption. The code "11 72" is a preamble address code that locates the beginning of the caption at row 2, with an indent of 4 columns. 20 The code "11 39" is a transparent space so that the first row of caption text "And now, a few words" is displayed on row 2, beginning at column five as illustrated in FIG. 13a. Similarly, the mid row code "12 54" is a preamble address code that locates the beginning of the second row of text at row 3 with an indent of 8 columns. 25 The code "14 21" is a backspace command so that the second row of caption text "from our sponsors." is displayed on row 3, beginning at column 7 as illustrated in FIG. 13a. The code "12 2F" is an end of caption command.

30 Thus the caption as broadcast is outside of the screen area designated for the display of closed captions. Therefore, the described exemplary ITV receiver may determine whether the closed caption as broadcast will fit in the designated screen area without modifying the horizontal placement of caption characters. 35 In this case the caption is horizontally bound by columns 6 and 25 which fit within the screen area designated for caption

1 display which is bound by columns 4 and 28. Therefore, the  
described exemplary ITV receiver replaces the row 2 and row 3  
positioning codes, 11 and 12 respectively, with codes for row 13  
5 and row 14, positioning codes 13 and 14 respectively. In this  
instance the closed caption will now be displayed within the  
screen area designated for the display of closed captions as  
illustrated in FIG. 13b.

10 FIGS. 14a and 14b provide an additional example of the  
modification of positioning codes to relocate a closed caption  
in an area allocated for the display of captions. In this  
example it is again assumed that the allocated area is bound by  
grid coordinates row 13 column 4 and row 14 column 28. It is  
further assumed that a caption comprising three rows of text,  
15 having the following positioning control codes, is received by  
the described exemplary ITV receiver.

14 20 11 74 11 39 11 39 And now, a few 12 52 11 39  
11 39 words from our 12 72 11 39 11 39 sponsors. 14 2F

20 In this example the caption as broadcast is horizontally  
bound by grid columns 10 and 23 and will therefore fit within the  
area allocated for the display of captions which is bound by grid  
columns 4 and 28. However, in this example the incoming caption  
25 comprises three rows and will not therefore fit within rows 13  
and 14 that have been allocated for the display of captions.  
Therefore, the described exemplary ITV receiver modifies the  
positioning control codes for the incoming three row, thirteen  
column caption for display in the two row, twenty five column  
30 area allocated for the display of captions in the ITV environment  
as illustrated in FIG. 14b. In operation, if the ITV receiver  
had not been able to modify the caption to fit within the area  
allocated for the display of captions, the ITV receiver would  
35 have switched to the roll-up mode of closed caption display.

FIGS. 15a and 15b provide an additional example of the



1 modification of positioning codes to relocate a closed caption  
in a screen area allocated for the display of captions. In this  
example it is again assumed that the allocated area is bound by  
5 grid coordinates row 13 column 4 and row 14 column 28. It is  
further assumed that a caption comprising one row of text having  
the following positioning control codes is received by the  
described exemplary ITV receiver.

10 14 20 14 70 11 39 We'll be back in two minutes. 14 2F

15 In this example the horizontal extent of the caption as  
broadcast, i.e. twenty eight columns, is wider than the twenty  
five columns allocated for the display of captions. Therefore,  
the described exemplary ITV receiver modifies the positioning  
control codes to display the caption in two rows within the area  
allocated for the display of captions as illustrated in FIG. 15b.

20 Although a preferred embodiment of the present invention has  
been described, it should not be construed to limit the scope of  
the appended claims. Those skilled in the art will understand  
that various modifications may be made to the described  
embodiment. Moreover, to those skilled in the various arts, the  
invention itself herein will suggest solutions to other tasks and  
adaptations for other applications. It is therefore desired that  
25 the present embodiments be considered in all respects as  
illustrative and not restrictive, reference being made to the  
appended claims rather than the foregoing description to indicate  
the scope of the invention.